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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/833,372	04/12/2001	Michael Wojtowicz	12-1100	3137

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EXAMINER
BAUMEISTER, BRADLEY W

ART UNIT	PAPER NUMBER
2815	

DATE MAILED: 03/20/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/833,372	Applicant(s) Wojtowicz
	Examiner B. William Baumeister	Art Unit 2815

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on *Jan 6, 2003* .

2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) *1-5 and 8-11* is/are pending in the application.

4a) Of the above, claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) *1-5 and 8-11* is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9) ☒ The specification is objected to by the Examiner.

10) ☐ The drawing(s) filed on _____ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) ☐ All b) ☐ Some* c) ☐ None of:

1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

a) ☐ The translation of the foreign language provisional application has been received.

15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____
4) ☐ Interview Summary (PTO-413) Paper No(s). _____
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Specification

1. The disclosure is objected to because of the following informalities:

a. Paragraph [0005] has been amended but still appears to include some clerical errors that render the disclosure confusing and/or inaccurate. The first two sentences as amended now recite, "holes are ejected from [sic: into] the emitter layer into [sic: from?] the base layer... The injection of holes into the base [sic: emitter?] layer..."

Appropriate correction or explanation as to why the amended language is correct is required.

Claim Rejections - 35 USC § 103

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

3. Claims 1, 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Song '944 in view of Chow '212.

a. Song generally discloses a GaN-based HBT (see FIG 3): on a substrate 5 is formed an n+ GaN subcollector 3; an n- GaN collector; a p+ GaN base; an n AlGaN emitter; and contacts formed on the subcollector, base and emitter, respectively. The claims are not anticipated because Song does not disclose an AlGaN/GaN superlattice employed for the base.

b. Chow '212 teaches that HBTs may be provided with graded or CHIRPed superlattices so that the effective bandgap of the base decreases from the emitter side to the collector side for improving electron drift across the base and that the bands of the base and emitter can be aligned (e.g., FIG 4 and col. 6, lines 23-44). It would have been obvious to one of ordinary skill in the art at the time of the invention to have employed a superlattice, at least such as a CHIRPed superlattice, in the base of the Song HBT for the purpose of improving the carrier drift as taught by Chow. Further, it would have been obvious to have employed a superlattice specifically composed of AlGaN/GaN because Song discloses an emitter composed of AlGaN and a collector composed of GaN, so using these specific materials in the superlattice would enable good lattice matching between the emitter, base and collector, and would allow alignment of the base and emitter bands.

4. Claim 5 is rejected--and claims 1, 8 and 9 are alternatively rejected--under 35 U.S.C. 103(a) as being unpatentable over Song/Chow as applied to the claims above, and further in view of Razeghi '277 (previously made of record in IDS #2).

a. As explained above, Chow provides motivation for ***why*** one would have wanted to employ an AlGaN/GaN superlattice in the base region of Song's (Al)GaN HBT. Assuming *arguendo* that Song and Chow must be read so narrowly as not sufficiently teaching that one actually ***could*** form a p+doped superlattice of AlGaN/GaN, Razeghi provides further evidence that it was known at the time of the invention by those skilled in the art how to form a p+

AlGaN/GaN superlattice. Thus, it would have been further obvious to form a base superlattice from the specific materials of AlGaN/GaN because these are the materials specifically employed in the various regions of Song and Razeghi teaches how to form a superlattice using these materials.

b. Regarding claim 5, Song doesn't disclose what particular materials may be used for the substrate on which the GaN-based HBT is grown. Razeghi teaches that sapphire or SiC may be employed as a substrate for GaN-based devices thereover (col. 3). It would have been obvious to one of ordinary skill in the art at the time of the invention to have employed sapphire or SiC for the substrate as taught by Razeghi because these are the two primary substrate materials used for GaN-based device due to lattice-matching issues.

5. Claims 2-4, 10 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Song/Chow or alternatively Song/Chow/Razeghi as applied to the claims above, and further in view of Ohta et al. 206.

a. The claims mentioned in the previous paragraphs set forth a superlattice (i.e., a structure having an irregular band gap energy), but do not further require that the AlGaN barriers be graded across the superlattice (i.e., do not require the barrier Al content to decrease from the emitter towards the collector). Claims 2-4, 10 and 11 do set forth this limitation; and Chow does not expressly teach this limitation because Chow alternatively uses CHIRPed superlattices to produce effective changes in the base's bandgap (i.e., wherein the barrier and well concentrations remain unchanged, but their successive, respective thicknesses are altered).

b. Ohta teaches that either barrier-thickness-grading or barrier-composition-grading can be employed in superlattices to produce effective band-gap changes in superlattice structures (see e.g., FIGs 14-21). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to have employed barrier-grading as taught by Ohta instead of the CHIRPing in the superlattice taught by Song/Chow, or alternatively Song/Chow/Razeghi, because the two grading schemes are functionally equivalent, both conventionally known at the time of the invention and because barrier-grading enables the use of constant thickness (i.e., thinner) barrier and well layers, and does not require taking into account the change of each barriers' and wells' respective thicknesses for design calculations.

Response to Arguments

6. Applicant's arguments filed 1/6/2003 have been fully considered but they are not persuasive.

a. Applicant has argued that neither Song nor Chow discloses a GaN/AlGaN material system as set forth in the claims, but rather that Song discloses a GaN/AlGaAs material system and that Chow discloses a GaSb/InAs/AsSb material system.

i. Applicant's reading of Song is too narrow. The (Al)GaAs region of Song, referenced by Applicant, is employed between the base region and base electrode to reduce resistance and make better ohmic contact. This additional feature was not relied upon by the Examiner in making the rejection. Rather, as was explained previously, Song--which teaches an

HBT having a GaN subcollector, collector and base; and an AlGaN emitter--was relied upon for the proposition that it was known to provide HBTs based on a GaN/AlGaN system.

ii. The Examiner agrees that Chow does not disclose a III-N material system, but Chow was not relied upon for it's particular material system. Rather, Chow was relied upon for its broader teaching that within an HBT of given material system, it was known to provide a graded superlattice base so that the effective bandgap decreases from the emitter towards the collector, as well as the teachings of what benefits are produced by employing such a superlattice grading scheme. Further, the fact that Chow employs a different material system does not teach away from the present invention, as alleged by Applicant, since nothing in Chow says that the disclosed superlattice grading scheme could not be used in other material systems, nor that it produces some results that are exclusively unique to the particular material system used therein.

b. Applicant has argued that the Examiner's further reliance upon Razeghi also does not render the claims obvious because the GaN/AlGaN superlattice of Razeghi is not employed as a superlattice in the base of an HBT, and therefore does not provide motivation to use it as such. The Examiner agrees that the Rezeghi superlattice is not disclosed as being usable for a base region of an HBT. However, this was not the basis for the Examiner's reliance on the reference. As was stated previously, Chow teaches ***why*** one would have wanted to employ a CHIRPed superlattice in the base of Song's (Al)GaN HBT. Razeghi was relied upon for its evidence that it was actually known how to make superlattices from this particular material system: i.e. given that

one would have wanted to make such a device, Razeghi teaches that it was also known that one ***could*** make such a device specifically from (Al)GaN.

c. Applicant has not disputed the Examiner's position that barrier-thickness-grading and barrier-composition-grading are functionally equivalent structures.

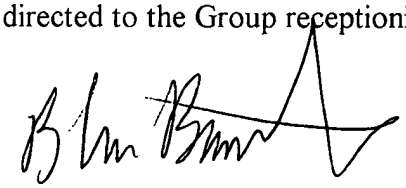
Conclusion

7. Applicant's amendment necessitated any new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

INFORMATION ON HOW TO CONTACT THE USPTO

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to the examiner, **B. William Baumeister,** at **(703) 306-9165.** The examiner can normally be reached Monday through Friday, 8:30 a.m. to 5:00 p.m. If the Examiner is not available, the Examiner's supervisor, Mr. Eddie Lee, can be reached at (703) 308-1690. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.



B. William Baumeister

Patent Examiner, Art Unit 2815

March 19, 2003